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UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

FOREST PRODUCTS LABORATORY

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WEATHERING AND DECAY

Two slow but important deteriorating influences against which wood should be guarded in service are weathering and decay. Either of these actions, if permitted, will finally cause serious disintegration of the wood. Decay, when it occurs, is a more rapid form of deterioration than weathering. Weathering and decay should be clearly distinguished from each other because they differ with respect to the causes producing them, the conditions favoring them, and the methods effective in combating them.

Weathering of wood is due partly to physical and partly to chemical changes in the wood. The physical changes are the result of the repeated unequal swelling and shrinking that accompany wetting and drying of the exposed wood surface. The surface layers of a wood member become alternately wet and dry with changes in climate. The interior of the member, however, remains dry or absorbs moisture only slowly, because moisture penetrates the wood slowly. Thus, the interior lags far behind the surface layers in swelling and shrinking. When the outer wood fibers swell and shrink, they are alternately squeezed together and pulled apart, and they become distorted. This results in "raising of the grain," checking, splitting, warping, cupping, and pulling at fastenings. Frost may also contribute to the weathering of wood.

The chemical changes result from the action of sunlight, air, and water on the surface layers of the wood. The surface of the wood first darkens to a brown color that soon penetrates 0.02 to 0.10 inch into the board. Then, a gray layer 0.003 to 0.01 inch thick develops on the exposed surface. In this layer, the normal arrangement of wood cells in orderly rows is lost, and only loosely matted fibers remain. Both cellulose and lignin become partly solubilized and leached from the brown and gray layers by rain until the gray layer loses most of its lignin and much of its cellulose. The more sensitive parts of the cellulose, the xylan and arabinan, are lost more rapidly than the galactan and mannan, and the more resistant glucosan is lost least

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rapidly. The brown and gray layers penetrate more deeply as wood wastes from the surface. In a century, about 0. 25 inch of wood is solubilized and leached from the surface. The loss may be twice as rapid during the first 15 or 20 years of weathering and correspondingly slower later on.

Decay, on the other hand, is caused by the action of wood-destroying fungi -- small living organisms that feed on the wood substance. The visible effect of the attack is familiar to everyone as "rotten" wood. Under conditions favorable to the development of decay organisms, the wood may be rendered unfit for service within a period of several months.

Weathering and decay are not usually found in the same place. Wood that is dry will not rot, because the fungi must have water to live on. On the other hand, weathering is usually found where the boards as a whole remain fairly dry. The surface layers of such boards periodically take up moisture, but drying occurs before the water can penetrate to the interior of the wood.

Typical cases of weathering in wood can be found in old shingles, and in unpainted house siding, board fences, and outdoor seating. Decay is more common in the bottom of steps of porches, the bases of porch and pergola columns, the lowest boards of siding that runs to the ground, the butts of untreated posts and poles, and other wood that is used in contact with the ground or in damp, unventilated places.

Protection against weathering can be obtained by the use of paint, varnish coatings, or water-repellent preparations. Such coatings, although not impermeable to moisture, protect the wood enough to prevent rapid changes of moisture content in the surface layers. Paint also screens off most of the light, especially the damaging ultraviolet light, and keeps it from reaching the wood. Varnish and other clear coatings furnish little protection against light. Paint and varnish do not preserve wood against decay. When wood must be used in places favorable to decay, a naturally durable wood should be selected, or, better yet, the wood should be impregnated with an effective preservative.

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